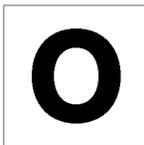


object: **1.** In image processing, a sub-region of an image that is perceived as a single entity. *Note:* An image can contain more than one object. **2.** In facsimile systems, the image, the likeness of which is to be transmitted.



object persistence: In a video display, distortion wherein the entirety of some object (or objects) that appeared in a previous frame (and that should no longer appear) remain in the current frame and in subsequent frames as a faded image or as an outline.

object retention: In a video display, distortion in which a fragment of an object that appeared in a previous frame (and should no longer appear) remains in the current and subsequent video frames.

OCC: *Abbreviation for other common carrier.*

occupancy: For equipment, such as a circuit or a switch, the ratio of the actual time in use to the available time during a 1-hour period. *Note 1:* Occupancy is usually expressed in percent. *Note 2:* Occupancy may be plotted versus time of day. *Synonym usage.*

occupied bandwidth: The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage $B/2$ of the total mean power of a given emission. Unless otherwise specified by the CCIR for the appropriate class of emission, the value of $B/2$ should be taken as 0.5%. [NTIA] [RR] (188) *Note 1:* The percentage of the total power outside the occupied bandwidth is represented by B . *Note 2:* In some cases, e.g., multichannel frequency-division multiplexing systems, use of the 0.5% limits may lead to certain difficulties in the practical application of the definition of occupied and necessary bandwidth; in such cases, a different percentage may prove useful.

oceanographic data interrogating station: A station in the maritime mobile service the emissions of which are used to initiate, modify or terminate functions of equipment directly associated with an oceanographic data station, including the station itself. [NTIA]

oceanographic data station: A station in the maritime mobile service located on a ship, buoy, or other sensor platform the emissions of which are used for transmission of oceanographic data. [NTIA]

OCR: *Abbreviation for optical character reader, optical character recognition.*

octet: A byte of eight binary digits usually operated upon as an entity. (188)

octet alignment: The configuration of a field composed of an integral number of octets. *Note:* If the field is not divisible by eight, bits (usually zeros) are added to either the first octet (left justification) or the last octet (right justification).

OD: *Abbreviation for optical density.*

odd-even check: *Synonym parity check.*

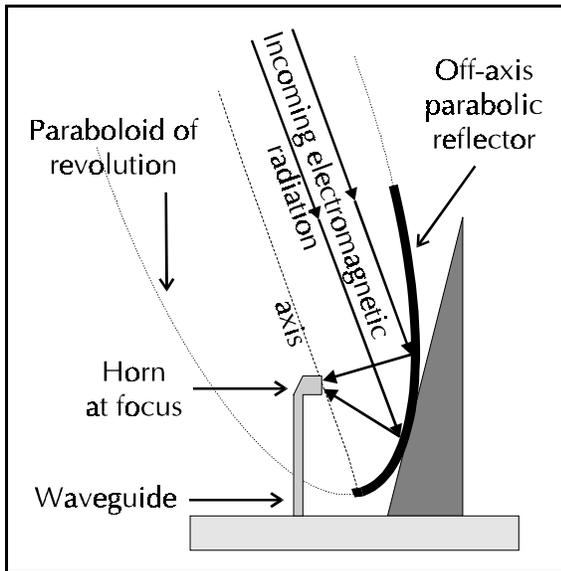
odd parity: *See parity, parity check.*

OFC: *Abbreviation for optical fiber, conductive.* *Note:* OFC is the designation given by the National Fire Protection Association (NFPA) to interior fiber-optic cables which contain at least one electrically conductive, non-current-carrying component, such as a metallic strength member or vapor barrier, and which are not certified for use in plenum or riser applications. [After FAA]

OFCP: *Abbreviation for optical fiber, conductive, plenum.* *Note:* OFCP is the designation given by the National Fire Protection Association (NFPA) to interior fiber-optic cables which contain at least one electrically conductive, non-current-carrying component such as a metallic strength member or vapor barrier, and which are certified for use in plenum applications. [After FAA]

OFRC: *Abbreviation for optical fiber, conductive, riser.* *Note:* OFRC is the designation given by the National Fire Protection Association (NFPA) to interior fiber-optic cables which contain at least one electrically conductive, non-current-carrying component such as a metallic strength member or vapor barrier, and which are certified for use in riser applications. [After FAA]

off-axis optical system: An optical system in which the optical axis of the aperture is not coincident with the mechanical center of the aperture. *Note:* The principal applications of off-axis optical systems are to avoid obstruction of the primary aperture by secondary optical elements, instrument packages, or sensors, and to provide ready access to instrument packages or sensors at the focus. The engineering tradeoff of an off-axis optical system is an increase in image aberrations.



off-axis optical system used as a microwave antenna system

off-hook: 1. In telephony, the condition that exists when an operational telephone instrument or other user instrument is in use, *i.e.*, during dialing or communicating. (188) *Note:* Off-hook originally referred to the condition that prevailed when the separate earpiece, *i.e.*, receiver, was removed from its switchhook, which extended from a vertical post that also supported the microphone, and which connected the instrument to the line when not depressed by the weight of the receiver. **2.** One of two possible signaling states, such as tone or no tone and ground connection versus battery connection. (188) *Note:* If off-hook pertains to one state, on-hook pertains to the other. **3.** The active state, *i.e.*, closed loop, of a subscriber or PBX user loop. (188) **4.** An operating state of a communications link in which data transmission is enabled either for (a)

voice or data communications or (b) network signaling.

off-hook service: *Synonym* **hotline.**

off-hook signal: In telephony, of a circuit, a signal indicating seizure, request for service, or a busy condition. (188)

office classification: Prior to divestiture, numbers that were assigned to offices according to their hierarchical function in the U.S. public switched telephone network. *Note 1:* The following class numbers are used:

Class 1: Regional Center (RC)

Class 2: Sectional Center (SC)

Class 3: Primary Center (PC)

Class 4: Toll Center (TC) [Only if operators are present; otherwise Toll Point (TP)]

Class 5: End Office (EO) [Local central office]

Note 2: Any one center handles traffic from one center to two or more centers lower in the hierarchy. Since divestiture, these designations have become less firm.

off line: 1. In computer technology, the state or condition of a device or equipment that is not under the direct control of another device. **2.** In computer technology, the status of a device that is disconnected from service.

off-line: 1. Pertaining to the operation of a functional unit when not under the direct control of the system with which it is associated. (188) *Note 1:* Off-line units are not available for immediate use on demand by the system. *Note 2:* Off-line units may be independently operated. **2.** Pertaining to equipment that is disconnected from a system, is not in operation, and usually has its main power source disconnected or turned off.

off-line recovery: The process of recovering nonprotected message traffic by use of an off-line processor or central processing unit. (188)

off-line storage: Storage that is not under the control of a processing unit.

off-net calling: The process by which telephone calls that originate or pass through private switching

systems in transmission networks are extended to stations in a public switched telephone system. (188)

off-premises extension (OPX): An extension telephone, PBX station, or key system station located on property that is not contiguous with that on which the main telephone, PBX, or key system is located.

off-the-air: 1. In radio communications systems, pertaining to a station that is completely shut down, *i.e.*, that is not transmitting any signal, not even an unmodulated carrier. **2.** In a radio station, pertaining to a particular source of modulation, such as a specific microphone, that is disconnected, *i.e.*, is no longer capable of modulating the carrier. *Note:* The carrier may continue unmodulated or it may be modulated by another signal source.

off-the-air monitoring: 1. In radio net operations, the listening, by the net-control station, to the transmissions of stations in the net, particularly to check the quality of their transmissions. *Note:* Off-the-air monitoring is usually performed during periods when the net-control station is not transmitting. **2.** The listening, by a radio station, to its own transmissions by receiving the signal that has been transmitted by the transmitting antenna, to discover the quality of the signal being transmitted to other stations or being broadcast. *Note:* In off-the-air monitoring, the received signal must have traveled through the air a reasonable distance from the transmitting antenna and not be a signal that is tapped on its way to the transmitting antenna internal to the station or in the antenna transmission line, *i.e.*, the feeder. The monitoring distance should be such that direct inductive or capacitive coupling between the transmitting antenna and monitor antenna does not occur. [From Weik '89]

off-the-shelf: Pertaining to equipment already manufactured and available for delivery from stock. (188)

OFN: *Abbreviation for optical fiber, nonconductive.* *Note:* OFN is the designation given by the National Fire Protection Association (NFPA) to interior fiber-optic cables which contain no electrically conductive component, and which are

not certified for use in plenum or riser applications. [After FAA]

OFNP: *Abbreviation for optical fiber, nonconductive, plenum.* *Note:* OFNP is the designation given by the National Fire Protection Association (NFPA) to interior fiber-optic cables which contain no electrically conductive component, and which are certified for use in plenum applications. [After FAA]

OFNR: *Abbreviation for optical fiber, nonconductive, riser.* *Note:* OFNR is the designation given by the National Fire Protection Association (NFPA) to interior fiber-optic cables which contain no electrically conductive component, and which are certified for use in riser applications. [After FAA]

oligarchically synchronized network: A synchronized network in which the timing of all clocks is controlled by a selected few clocks.

Omega: A global radionavigation system that enables user with special receivers to obtain position information by measuring phase difference between precisely timed signals radiated by a network of eight transmitting stations deployed worldwide. (188) *Note:* The transmitted signals time-share transmission on frequencies of 10.2, 11.05, 11.33, and 13.6 kHz. Since the transmissions are coordinated with UTC (USNO), they also provide time reference.

omnidirectional antenna: An antenna that has a radiation pattern that is nondirectional in azimuth. (188) *Note:* The vertical radiation pattern may be of any shape.

omnidirectional range station: A radionavigation land station in the aeronautical radionavigation service providing direct indication of the bearing (omnibearing) of that station from an aircraft. [NTIA]

ONA: *Abbreviation for open network architecture.*

on-board communication station: A low-powered mobile station in the maritime mobile service intended for use for internal communications on

board a ship, or between a ship and its lifeboats and liferafts during lifeboat drills or operations, or for communication within a group of vessels being towed or pushed, as well as for line handling and mooring instructions. [NTIA] [RR]

144-line weighting: In telephony, a noise weighting used in a noise measuring set to measure line noise as it would be perceived if the line were terminated with a No. 144-receiver, or a similar instrument. (188) *Note:* The meter scale readings are in dBrn (144-line).

144-receiver weighting: In telephony, a noise weighting used in a noise measuring set to measure noise across the receiver of an instrument equipped with a No. 144-receiver. (188) *Note:* The meter scale readings are in dBrn (144-receiver).

one-way communication: Communication in which information is always transferred in only one preassigned direction. *Note 1:* One-way communication is not necessarily constrained to one transmission path. *Note 2:* Examples of one-way communications systems include broadcast stations, one-way intercom systems, and wireline news services.

one-way-only channel: A channel capable of transmission in only one direction, which cannot be reversed. (188) *Synonym* **unidirectional channel.**

one-way operation: *Synonym* **simplex operation (def. #1).**

one-way reversible operation: *Synonym* **half-duplex operation.**

one-way trunk: A trunk between two switching centers, over which traffic may be originated from one preassigned location only. (188) *Note 1:* The traffic may consist of two-way communications; the expression “one way” refers only to the origin of the demand for a connection. *Note 2:* At the originating end, the one-way trunk is known as an “outgoing trunk”; at the other end, it is known as an “incoming trunk”.

on-hook: 1. In telephony, the condition that exists when an operational telephone, or other user instrument, is not in use. (188) *Note:* On-hook

originally referred to the storage of an idle telephone receiver, *i.e.*, separate earpiece, on a hook that extended from a vertical post that supported the microphone also. The hook was mechanically connected to a switch that automatically disconnected the idle telephone from the network.

2. One of two possible signaling states, such as tone or no tone, or ground connection versus battery connection. (188) *Note:* If on-hook pertains to one state, off-hook pertains to the other. **3.** The idle state, *i.e.*, open loop, of a subscriber or PBX user loop. (188) **4.** An operating state of a communications link in which data transmission is disabled and a high-impedance, *i.e.*, open circuit, is presented to the link by the end instrument(s). *Note:* During the on-hook condition, the link is responsive to ringing signals.

on-hook signal: In telephony, of a circuit, a signal indicating a disconnect, unanswered call, or an idle condition. (188)

on line: 1. In computer technology, the state or condition of a device or equipment that is under the direct control of another device. **2.** In computer technology, the status of a device that is functional and ready for service.

on-line: 1. Pertaining to the operation of a functional unit when under the direct control of the system with which it is associated. (188) *Note 1:* On-line units are available for immediate use on demand by the system without human intervention. *Note 2:* On-line units may not be independently operated. **2.** Pertaining to equipment that is connected to a system, and is in operation.

online computer system: A computer system that is a part of, or is embedded in, a larger entity, such as a communications system, and that interacts in real or near-real time with the entity and its users.

on-premises extension: An extension telephone, PBX station, or key system station located on property that is contiguous with that on which the main telephone, PBX, or key system is located.

on-premises wiring: Customer-owned metallic or optical-fiber communications transmission lines, installed within or between buildings. *Note:* On-

premises wiring may consist of horizontal wiring, vertical wiring, and backbone wiring, and may extend from the external network interface to the user work station areas. It includes the total communications wiring to transport current or future data, voice, LAN, and image information.

on-the-air: **1.** In radio communications systems, pertaining to a station that is transmitting a carrier, whether or not the carrier is modulated. **2.** In a radio station, pertaining to a particular source of modulation, such as a specific microphone, that is connected, *i.e.*, is capable of modulating the carrier.

open circuit: **1.** In communications, a circuit available for use. (188) **2.** In electrical engineering, a circuit that contains an essentially infinite impedance. *Note:* An open circuit may be intentional, as in a switch, or may constitute a fault, as in a severed cable.

open dual bus: A dual bus in which the head-of-bus functions for both buses are at different locations.

open network architecture (ONA): In the context of the FCC's Computer Inquiry III, the overall design of a communication carrier's basic network facilities and services to permit all users of the basic network to interconnect to specific basic network functions and interfaces on an unbundled, equal-access basis. *Note:* The ONA concept consists of three integral components: (a) basic serving arrangements (BSAs), (b) basic service elements (BSEs), and (c) complementary network services.

open system: A system with characteristics that comply with specified, publicly maintained, readily available standards and that therefore can be connected to other systems that comply with these same standards.

open systems architecture: **1.** The layered hierarchical structure, configuration, or model of a communications or distributed data processing system that (a) enables system description, design, development, installation, operation, improvement, and maintenance to be performed at a given layer or layers in the hierarchical structure, (b) allows each layer to provide a set of accessible functions that can be controlled and used by the functions in the layer

above it, (c) enables each layer to be implemented without affecting the implementation of other layers, and (d) allows the alteration of system performance by the modification of one or more layers without altering the existing equipment, procedures, and protocols at the remaining layers. *Note 1:* Examples of independent alterations include (a) converting from wire to optical fibers at a physical layer without affecting the data-link layer or the network layer except to provide more traffic capacity, and (b) altering the operational protocols at the network level without altering the physical layer. *Note 2:* Open systems architecture may be implemented using the Open Systems Interconnection—Reference Model (OSI—RM) as a guide while designing the system to meet performance requirements. **2.** Nonproprietary systems architecture.

Open Systems Interconnection (OSI): Pertaining to the logical structure for communications networks standardized by the International Organization for Standardization (ISO). *Note:* Adherence to the standard enables any OSI-compliant system to communicate with any other OSI-compliant system for a meaningful exchange of information.

Open Systems Interconnection (OSI)—Architecture: Communications system architecture that adheres to the set of ISO standards relating to open systems architecture.

Open Systems Interconnection (OSI)—Protocol Specification: The lowest level of abstraction within the OSI standards scheme. *Note:* Each OSI—Protocol Specification operates at a single layer. Each defines the primitive operations and permissible responses required to exchange information between peer processes in communicating systems to carry out all or a subset of the services defined within the OSI—Service Definitions for that layer.

Open Systems Interconnection—Reference Model (OSI—RM): An abstract description of the digital communications between application processes running in distinct systems. The model employs a hierarchical structure of seven layers. Each layer performs value-added service at the request of the adjacent higher layer and, in turn, requests more basic services from the adjacent lower layer:

➤ **Physical Layer:** Layer 1, the lowest of seven hierarchical layers. The Physical layer performs services requested by the Data Link Layer. The major functions and services performed by the physical layer are: (a) establishment and termination of a connection to a communications medium; (b) participation in the process whereby the communication resources are effectively shared among multiple users, *e.g.*, contention resolution and flow control; and, (c) conversion between the representation of digital data in user equipment and the corresponding signals transmitted over a communications channel.

➤ **Data Link Layer:** Layer 2. This layer responds to service requests from the Network Layer and issues service requests to the Physical Layer. The Data Link Layer provides the functional and procedural means to transfer data between network entities and to detect and possibly correct errors that may occur in the Physical Layer. *Note:* Examples of data link protocols are HDLC and ADCCP for point-to-point or packet-switched networks and LLC for local area networks.

➤ **Network Layer:** Layer 3. This layer responds to service requests from the Transport Layer and issues service requests to the Data Link Layer. The Network Layer provides the functional and procedural means of transferring variable length data sequences from a source to a destination via one or more networks while maintaining the quality of service requested by the Transport Layer. The Network Layer performs network routing, flow control, segmentation/desegmentation, and error control functions.

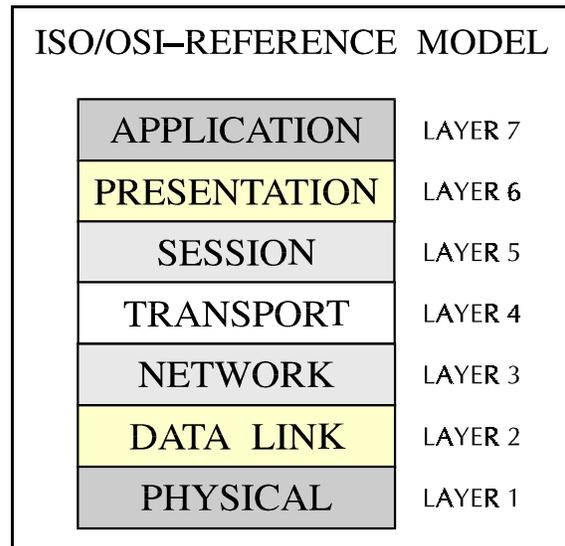
➤ **Transport Layer:** Layer 4. This layer responds to service requests from the Session Layer and issues service requests to the Network Layer. The purpose of the Transport Layer is to provide transparent transfer of data between end users, thus relieving the upper layers from any concern with providing reliable and cost-effective data transfer.

➤ **Session Layer:** Layer 5. This layer responds to service requests from the Presentation Layer and issues service requests to the Transport Layer. The Session Layer provides the mechanism for managing the dialogue between end-user application processes. It provides for either duplex or half-duplex operation and establishes checkpointing, adjournment, termination, and restart procedures.

➤ **Presentation Layer:** Layer 6. This layer responds to service requests from the Application

Layer and issues service requests to the Session Layer. The Presentation Layer relieves the Application Layer of concern regarding syntactical differences in data representation within the end-user systems. *Note:* An example of a presentation service would be the conversion of an EBCDIC-coded text file to an ASCII-coded file.

➤ **Application Layer:** Layer 7, the highest layer. This layer interfaces directly to and performs common application services for the application processes; it also issues requests to the Presentation Layer. The common application services provide semantic conversion between associated application processes. *Note:* Examples of common application services of general interest include the virtual file, virtual terminal, and job transfer and manipulation protocols.



Open Systems Interconnection—Reference Model

Open Systems Interconnection (OSI)—Service Definitions: The next lower level of abstraction below that of the OSI—Reference Model. The OSI—Service Definitions for each layer define the layer’s abstract interface and the facilities provided to the user of the service independent of the mechanism used to accomplish the service.

Open Systems Interconnection (OSI)—Systems Management: In the Application Layer of the OSI—Reference Model (OSI—RM), the set of functions related to the management and status of

various resources identified in all layers of the OSI—RM.

open waveguide: An all-dielectric waveguide in which electromagnetic waves are guided by a refractive index gradient so that the waves are confined to the guide by refraction or reflection from the outer surface of the guide or from surfaces within the guide. *Note 1:* In an open waveguide, the electromagnetic waves propagate, without radiation, within the waveguide, although evanescent waves coupled to internal waves may travel in the space immediately outside the waveguide. *Note 2:* Examples of open waveguides are (a) optical fibers and (b) planar waveguides in integrated optical circuits. [From Weik '89]

open wire: Conductors that are separately supported with insulators on poles or towers above the surface of the Earth. (188) *Note 1:* Open wire conductors may be insulated or uninsulated. *Note 2:* Open wire may be used in both communication applications and power applications.

operand: An entity on which an operation is performed.

operating system: An integrated collection of routines that service the sequencing and processing of programs by a computer. *Note:* An operating system may provide many services, such as resource allocation, scheduling, input/output control, and data management. Although operating systems are predominantly software, partial or complete hardware implementations may be made in the form of firmware. (188)

operating time: **1.** The time interval between the instant of occurrence of a specified input condition to a system and the instant of completion of a specified operation. **2.** In communications, computer, and information processing systems, the time interval between the instant a request for service is received from a user and the instant of final release of all facilities by the user or either of two users. (188) **3.** In communications systems conference calls, the time interval between the instant a request for service is received from one of a group of concurrent users and the instant all but one of the users have released all facilities.

operation: **1.** The method, act, process, or effect of using a device or system. (188) **2.** A well-defined action that, when applied to any permissible combination of known entities, produces a new entity, *e.g.*, the process of addition in arithmetic—in adding 5 and 3 to obtain 8, the numbers 5 and 3 are the operands, the number 8 is the result, and the plus sign is the operator indicating that the operation performed is addition. **3.** A program step, usually specified by a part of an instruction word, that is undertaken or executed by a computer. *Note:* Examples of operations include addition, multiplication, extraction, comparison, shift, transfer.

operational load: The total power requirements for communications facilities. (188)

operational service period: **1.** A period during which a telecommunications service remains in an operational state. *Note:* The operational state must be defined in accordance with specified criteria. **2.** A performance measurement period, or succession of performance measurement periods, during which a telecommunications service remains in an operational service state. (188) *Note:* An operational service period begins at the beginning of the performance measurement period in which the telecommunications service enters the operational service state, and ends at the beginning of the performance measurement period in which the telecommunications service leaves the operational service state.

operational service state: During any performance measurement period, a telecommunications service condition that existed when the calculated values of specified performance parameters were equal to or better than their associated outage thresholds. (188)

operations security: [The] process denying to potential adversaries information about capabilities and/or intentions by identifying, controlling and protecting generally unclassified evidence of the planning and execution of sensitive activities. [NIS]

operations system: In network management, a system that processes telecommunications management information and that supports and controls the performance of various telecommunications management functions. (188)

Note: An operations system performs surveillance and testing functions to support customer access maintenance.

OPSEC: *Acronym for operations security.*

optical amplifier: *See fiber amplifier, optical repeater.*

optical attenuator: In optical communications, a device used to reduce the power level of an optical signal. *Note 1:* Optical attenuators used in fiber optic communications systems may use a variety of principles for their functioning. Those using the gap-loss principle are sensitive to the modal distribution ahead of the attenuator, and should be used at or near the transmitting end, or they may introduce less loss than intended. Optical attenuators using absorptive or reflective techniques avoid this problem. *Note 2:* The basic types of optical attenuators are fixed, step-wise variable, and continuously variable.

optical axis: 1. Of a refractive or reflective optical element, the straight line that is coincident with the axis of symmetry of the surfaces. *Note:* The optical axis of a system is often coincident with its mechanical axis, but it need not be, *e.g.*, in the case of an off-axis parabolic reflector used to transmit signals to, or receive signals from, a geosynchronous satellite. *Contrast with off-axis optical system. 2.* In a lens element, the straight line which passes through the centers of curvature of the lens surfaces. [JP1] **3.** In an optical system, the line formed by the coinciding principal axes of the series of optical elements. [JP1] **4.** In an optical fiber, *synonym fiber axis*, which is the preferred term.

optical beamsplitter: *See beamsplitter.*

optical cable: *See fiber optic cable.*

optical cable assembly: *See cable assembly.*

optical cavity: A region bounded by two or more mirrors that are aligned to provide multiple reflections of lightwaves. *Note:* The resonator in a laser is an optical cavity. *In this sense, synonym resonant cavity.*

optical character reader (OCR): A device used for optical character recognition.

optical character recognition (OCR): The machine identification of printed characters through use of light-sensitive devices. (188)

optical conductor: *Deprecated synonym for optical fiber.*

optical connector: A demountable device for attaching a cabled or uncabled optical fiber to another, or to an active device such as a transmitter. *Note 1:* A connector is distinguished by the fact that it may be disconnected and reconnected, as opposed to a splice, which permanently joins two fibers. *Note 2:* Optical connectors are sometimes erroneously referred to as “*couplers*.” Such usage is incorrect and is to be avoided. [After FAA]

optical coupler: *See directional coupler, star coupler (def.# 1), T-coupler.*

optical density (OD): For a given wavelength, an expression of the transmittance of an optical element. *Note 1:* Optical density is expressed by $\log_{10}(1/T)$ where T is transmittance. (188) *Note 2:* The higher the optical density, the lower the transmittance. *Note 3:* Optical density times 10 is equal to transmission loss expressed in decibels, *e.g.*, an optical density of 0.3 corresponds to a transmission loss of 3 dB.

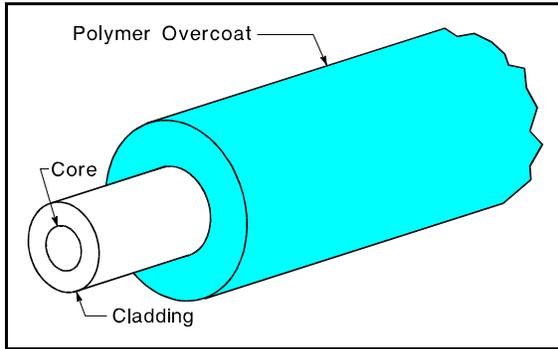
optical detector: A transducer that generates an output signal when irradiated with optical energy. (188)

optical disk: A flat, circular, plastic disk coated with material on which bits may be stored in the form of highly reflective areas and significantly less reflective areas, from which the stored data may be read when illuminated with a narrow-beam source, such as a laser diode. *Note:* The bits are stored sequentially on a continuous spiral track.

optical dispersion: *See dispersion.*

optical fiber: A filament of transparent dielectric material, usually glass or plastic, and usually circular in cross section, that guides light. (188) *Note 1:* An

optical fiber usually has a cylindrical core surrounded by, and in intimate contact with, a cladding of similar geometry. *Note 2:* The refractive index of the core must be slightly higher than that of the cladding for the light to be guided by the fiber. *Synonym* **lightguide**.



optical fiber

optical fiber cable: *See* **fiber optic cable**.

optical fiber coating: *See* **primary coating**.

optical fiber, conductive: *See* **OFC**.

optical fiber, conductive, plenum: *See* **OFCP**.

optical fiber, conductive, riser: *See* **OFCR**.

optical fiber jacket: *See* **sheath**.

optical fiber link: *See* **fiber optic link**.

optical fiber, nonconductive: *See* **OFN**.

optical fiber, nonconductive, plenum: *See* **OFNP**.

optical fiber, nonconductive, riser: *See* **OFNR**.

optical fiber nuclear hardening: Design allowances made to prevent or ameliorate the effects of gamma or high-energy neutron radiation or bombardment, that causes some optical fibers to darken, increase attenuation, or depart from normal operating parameters. *Note:* Light sources, such as LEDs and lasers, and photodetectors, also need to be hardened to prevent similar malfunctions. [From Weik '89]

optical fiber transfer function: *See* **transfer function**.

optical fiber waveguide: *See* **optical fiber**.

optical filter: In the optical regime, an element that selectively transmits or blocks a range of wavelengths.

optical heterodyning: *See* **optical mixing**.

optical interface: In a fiber optic communications link, a point at which an optical signal is passed from one equipment or medium to another without conversion to an electrical signal.

optical isolator: A device that uses a short optical transmission path to accomplish electrical isolation between elements of a circuit. *Note 1:* The optical path may be air or a dielectric waveguide. *Note 2:* The transmitting and receiving elements of an optical isolator may be contained within a single compact module, for mounting, *e.g.*, on a circuit board. *Synonym* **optoisolator**.

optical junction: Any physical interface in a fiber optic system. (188) *Note:* Source to fiber, fiber to fiber, fiber to detector, beam to prism (or lens), fiber to lens, lens to fiber, are examples of optical junctions.

optical line code: Sequences of optical pulses suitably structured to permit information transfer over an optical link.

optical link: An optical transmission channel, including any repeaters or regenerative repeaters, designed to connect two electronic or optoelectronic communications terminals. *Note:* An optical link is sometimes held to include the terminal optical transmitters and receivers, especially in the case of a communications link utilizing separate electronic terminals originally designed for metallic transmission, and retrofitted for optical transmission. [After FAA]

optically active material: A material that rotates the plane of polarization of light that passes through it. (188)

optical mixing: Optical beating, *i.e.*, the mixing, *i.e.*, heterodyning, of two lightwaves (incoming signal and local oscillator) in a nonlinear device to produce a beat frequency low enough to be further processed

by conventional electronic circuitry. *Note:* Optical mixing is the optical analog of heterodyne reception of radio signals. [After FAA] *Synonym* **optical heterodyning**.

optical multiplexing: *See* **wavelength-division multiplexing**.

optical path length: **1.** In a medium of constant refractive index, n , the product of the geometric distance and the refractive index. **2.** In a medium of varying refractive index, the integral of $n\delta s$, where δs is an element of length along the path, and n is the local refractive index. (188) *Note:* Optical path length is proportional to the phase shift that a lightwave undergoes along a path.

optical power: *See* **radiant power**.

optical power budget: In a fiber-optic communication link, the allocation of available optical power (launched into a given fiber by a given source) among various loss-producing mechanisms such as launch coupling loss, fiber attenuation, splice losses, and connector losses, in order to ensure that adequate signal strength (optical power) is available at the receiver. *Note 1:* The optical power budget is usually specified or expressed in dB. *Note 2:* The amount of optical power launched into a given fiber by a given transmitter depends on the nature of its active optical source (LED or laser diode) and the type of fiber, including such parameters as core diameter and numerical aperture. Manufacturers sometimes specify an optical power budget only for a fiber that is optimum for their equipment—or specify only that their equipment will operate over a given distance, without mentioning the fiber characteristics. The user must first ascertain, from the manufacturer or by testing, (a) the transmission losses for the type of fiber to be used, (b) the required signal strength for a given level of performance. *Note 3:* In addition to transmission loss, including those of any splices and connectors, allowance should be made for at least several dB of optical power margin losses, to compensate for component aging and to allow for future splices in the event of a severed cable. *Contrast with* **optical power margin, bandwidth-limited operation**.

optical power margin: In an optical communications link, the difference between (a) the optical power

that is launched by a given transmitter into the fiber, less transmission losses from all causes, and (b) the minimum optical power that is required by the receiver for a specified level of performance. *Note 1:* The optical power margin is usually expressed in dB. At least several dB of optical power margin should be included in the optical power budget. *Note 2:* The amount of optical power launched into a given fiber by a given transmitter depends on the nature of its active optical source (LED or laser diode) and the type of fiber, including such parameters as core diameter and numerical aperture. *Contrast with* **optical power budget**.

optical receiver: A device that detects an optical signal, converts it to an electrical signal, and processes the electrical signal as required for further use. (188)

optical regenerator: *See* **optical repeater**.

optical repeater: In an optical communication system, an optoelectronic device or module that receives an optical signal, amplifies it (or, in the case of a digital signal, reshapes, retimes, or otherwise reconstructs it), and retransmits it as an optical signal. (188)

optical source: **1.** In optical communications, a device that converts an electrical signal into an optical signal. *Note:* The two most commonly used optical sources are light-emitting diodes (LEDs) and laser diodes. **2.** Test equipment that generates a stable optical signal for the purpose of making optical transmission loss measurements. [After FAA]

optical spectrum: By custom and practice, the electromagnetic spectrum between the wavelengths of the vacuum ultraviolet at 0.001 μm and the far infrared at 100 μm . *Note:* The term “*optical spectrum*” originally applied only to that region of the electromagnetic spectrum visible to the normal human eye, but is now considered to include all wavelengths between the shortest wavelengths of radio and the longest of x-rays. At this writing, no formal spectral limits are recognized nationally or internationally.

optical splitter: *See* **directional coupler**.

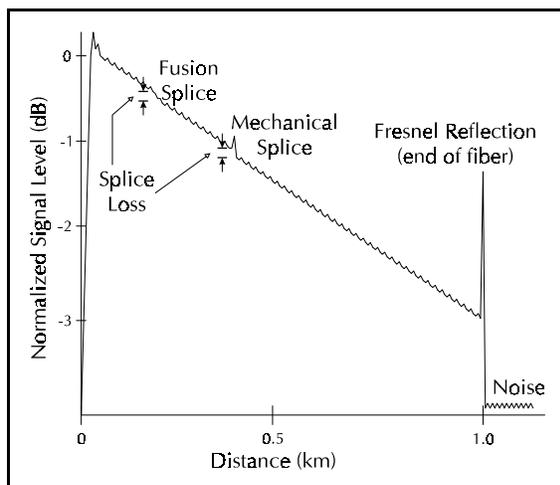
optical switch: A switch that enables signals in optical fibers or integrated optical circuits (IOCs) to be selectively switched from one circuit to another.

Note 1: An optical switch may operate by (a) mechanical means such as physically shifting an optical fiber to drive one or more alternative fibers, or (b) electro-optic effects, magneto-optic effects, or other methods. *Note 2:* Slow optical switches, such as those using moving fibers, may be used for alternate routing of an optical transmission path, e.g., routing around a fault. Fast optical switches, such as those using electro-optic or magneto-optic effects, may be used to perform logic operations.

optical system power margin: *See power margin.*

optical thickness: **1.** The product of the physical thickness of an isotropic optical element and its refractive index. **2.** Of an optical system, the total optical path length through all elements. (188)

optical time domain reflectometer (OTDR): An optoelectronic instrument used to characterize an optical fiber. *Note 1:* An OTDR injects a series of optical pulses into the fiber under test. It also extracts, from the same end of the fiber, light that is scattered back and reflected back. The intensity of the return pulses is measured and integrated as a function of time, and is plotted as a function of fiber length. *Note 2:* An OTDR may be used for estimating the fiber's length and overall attenuation, including splice and mated-connector losses. It may also be used to locate faults, such as breaks.



representative OTDR trace

optical transmittance: *See transmittance.*

optical transmitter: A device that accepts an electrical signal as its input, processes this signal, and uses it to modulate an opto-electronic device, such as an LED or an injection laser diode, to produce an optical signal capable of being transmitted via an optical transmission medium. (188)

optical waveguide: Any structure having the ability to guide optical energy. (188) *Note:* Optical waveguides may be (a) thin-film deposits used in integrated optical circuits (IOCs) or (b) optical fibers.

optimum traffic frequency: *Synonym FOT.*

optimum transmission frequency: *Synonym FOT.*

optimum working frequency: *Synonym FOT.*

optoelectronic: Pertaining to any device that functions as an electrical-to-optical or optical-to-electrical transducer, or an instrument that uses such a device in its operation. (188) *Note 1:* Photodiodes, LEDs, injection laser diodes, and integrated optical circuit (IOC) elements are examples of optoelectronic devices commonly used in optical fiber communications. *Note 2:* "Electro-optical" is often erroneously used as a synonym.

optoisolator: *Synonym optical isolator.*

OPX: *Abbreviation for off-premises extension.*

orbit: The path, relative to a specified frame of reference, described by the center of mass of a satellite or other object in space subjected primarily to natural forces, mainly the force of gravity. [NTIA] [RR]

orbit determination: The process of describing the past, present, or predicted position of a satellite in terms of orbital parameters. [JP1]

order of diversity: The number of independently fading propagation paths or frequencies, or both, used in diversity reception. (188)

orderwire circuit: A voice or data circuit used by technical control and maintenance personnel for coordination and control actions relative to activation, deactivation, change, rerouting, reporting, and maintenance of communication systems and services. (188) *Synonyms* **engineering channel, engineering orderwire, service channel.**

orderwire multiplex: A multiplex carrier set specifically designed for the purpose of carrying orderwire traffic, as opposed to one designed for carrying mission traffic. (188)

ordinary ray: *See* **birefringence.**

organizer: *See* **splice organizer.**

originating user: The user that initiates a particular information transfer transaction. *Note:* The originating user may be either the source user or the destination user.

originator: *See* **access originator, disengagement originator.**

originator-to-recipient speed of service: *Synonym* **speed of service (def. #1).**

orthogonal multiplex: A method of combining two or more digital signals that have mutually independent pulses, thus avoiding intersymbol interference. (188)

orthomode transducer: A device forming part of an antenna feed and serving to combine or separate orthogonally polarized signals.

oscillator: An electronic circuit designed to produce an ideally stable alternating voltage or current.

OSI: *Abbreviation for* **Open Systems Interconnection.**

OSI—RM: *Abbreviation for* **Open Systems Interconnection—Reference Model.**

OTAR: *Abbreviation for* **over-the-air rekeying.**

OTDR: *Abbreviation for* **optical time domain reflectometer.**

other common carrier (OCC): A communications common carrier—usually an interexchange carrier—that offers communications services in competition with AT&T and/or the established U.S. telephone local exchange carriers.

outage: A telecommunications system service condition in which a user is completely deprived of service by the system. (188) *Note:* For a particular system or a given situation, an outage may be a service condition that is below a defined system operational threshold, *i.e.*, below a threshold of acceptable performance. *See* **outage threshold.**

outage duration: That period of time between the onset of an outage and the restoration of service. (188)

outage probability: The probability that an outage will occur within a specified time period.

outage ratio: The sum of all the outage durations divided by the time period of measurement.

outage state: *See* **outage.**

outage threshold: For a supported performance parameter of a system, the value that establishes the minimum performance level at which the system is considered to remain in an operational state. (188) *Note:* A measured parameter value better than the outage threshold indicates that the system is in a system operational state.

out-of-band emission: Emission on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious emission. [NTIA] [RR]

out-of-band signaling: **1.** Signaling that uses a portion of the channel bandwidth provided by the transmission medium, *e.g.*, the carrier channel, which portion is above the highest frequency used by, and is denied to, the speech or intelligence path by filters. *Note:* Out-of-band signaling results in a lowered high-frequency cutoff of the effective available bandwidth. **2.** Signaling via a different channel (either FDM or TDM) from that used for the primary information transfer. (188) *Contrast with*

common-channel signaling, in-band signaling, out-slot signaling.

out-of-frame-alignment time: The time during which frame alignment is effectively lost. (188)
Note: The out-of-frame-alignment time includes the time to detect loss of frame alignment and the alignment recovery time.

outpulsing: The process of transmitting address information over a trunk from one switching center or switchboard to another. (188)

output: **1.** Information retrieved from a functional unit or from a network, usually after some processing. **2.** An output state, or sequence of states. **3.** Pertaining to a device, process, or channel involved in the production of data by a computer or by any of its components.

output angle: *Synonym radiation angle.*

output rating: **1.** The expression of the stated power available at the output terminals of a transmitter when connected to the normal load or its equivalent. (188) **2.** Under specified ambient conditions, the expression of the power that can be delivered by a device over a long period of time without overheating. (188)

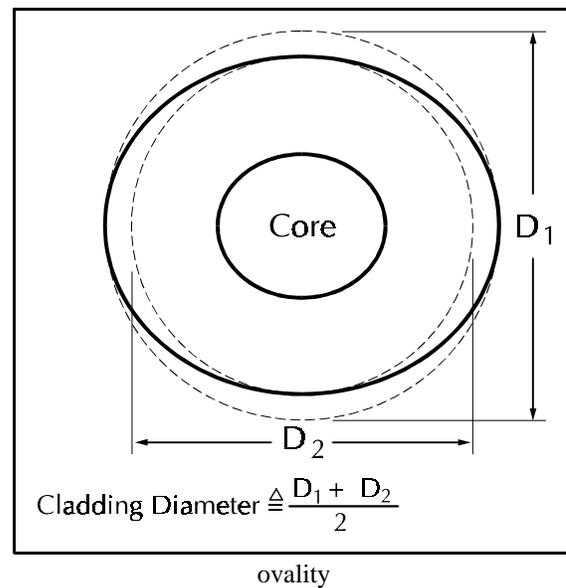
outside plant: **1.** In telephony, all cables, conduits, ducts, poles, towers, repeaters, repeater huts, and other equipment located between a demarcation point in a switching facility and a demarcation point in another switching facility or customer premises. *Note:* The demarcation point may be at a distribution frame, cable head, or microwave transmitter. **2.** In DOD communications, the portion of intrabase communications equipment between the main distribution frame (MDF) and a user end instrument or the terminal connection for a user instrument. (188)

out-slot signaling: Signaling performed in digital time slots that are not within the channel time slot.
Contrast with out-of-band signaling.

outward dialing: *See direct outward dialing.*

ovality: **1.** The attribute of an optical fiber, the cross section of the core or cladding of which deviates

from a perfect circle. **2.** In an optical fiber, the degree of deviation, from perfect circularity, of the cross section of the core or cladding. *Note 1:* The cross sections of the core and cladding are assumed to first approximation to be elliptical. Quantitatively, the ovality of either the core or cladding is expressed as $2(a-b)/(a+b)$, where a is the length of the major axis and b is the length of the minor axis. The dimensionless quantity so obtained may be multiplied by 100 to express ovality as a percentage. *Note 2:* Alternatively, ovality of the core or cladding may be expressed or specified by a tolerance field consisting of two concentric circles, within which the cross section boundaries must lie. *Synonym noncircularity.*



overflow: **1.** The condition that prevails when the numerical aperture of an optical source, such as a laser, light-emitting diode, or optical fiber, exceeds that of the driven element, *e.g.*, optical fiber core. **2.** The condition that prevails when the beam diameter of an optical source, such as a laser, light-emitting diode, or optical fiber, exceeds that of the driven element, *e.g.*, optical fiber core. *Note:* In optical communications testing, overflow in both numerical aperture and mean diameter (core diameter or spot size) is usually required.

overflow: **1.** In telephony, the generation of potential traffic that exceeds the capacity of a communications system or subsystem. (188) **2.** In telephony, a count

of telephone call attempts made on groups of busy trunks or access lines. **3.** In telephony, traffic handled by overflow equipment. **4.** In telephony, traffic that exceeds the capacity of the switching equipment and is therefore lost. (188) **5.** In telephony, on a particular route, excess traffic that is offered to another route, *i.e.*, an alternate route. (188) **6.** In digital computing, *synonym for arithmetic overflow*. **7.** In digital communications, the condition that exists when the incoming data rate exceeds that which can be accommodated by a buffer, resulting in the loss of information.

overhead bit: Any bit other than a user information bit. (188)

overhead communications: *See* overhead bit.

overhead information: Digital information transferred across the functional interface between a user and a telecommunications system, or between functional units within a telecommunications system, for the purpose of directing or controlling the transfer of user information or the detection and correction of errors. (188) *Note:* Overhead information originated by the user is not considered to be system overhead information. Overhead information generated within the communications system and not delivered to the user is system overhead information. Thus, the user throughput is reduced by both overheads while system throughput is reduced only by system overhead.

overlay: **1.** One of several segments of a computer program that, during execution, occupies the same area of main storage, one segment at a time. **2.** To use repeatedly the same areas of internal storage during different stages of the execution of a program. (188)

overload: A load, placed on a device or facility, that is greater than the device or facility is capable of handling, *i.e.*, capable of performing the functions for which it was designed. *Note:* Examples of overloads are (a) traffic on a communications system greater than the traffic capacity of the system, (b) for analog inputs, voltage levels above which an analog-to-digital converter cannot distinguish a change, and (c) in electrical circuits, an electrical current that will result in damage from overheating. [From Weik '89]

overload point: *Synonym* load capacity.

overmodulation: **1.** The condition that prevails when the instantaneous level of the modulating signal exceeds the value necessary to produce 100% modulation of the carrier. *Note 1:* Overmodulation results in spurious emissions by the modulated carrier, and distortion of the recovered modulating signal. *Note 2:* Overmodulation in the sense of this definition is almost always considered a fault condition. **2.** The condition that prevails when the mean level of the modulating signal is such that peaks in the modulating signal exceed the value necessary to produce 100% modulation of the carrier. *Note:* Overmodulation in the sense of this definition, if not excessive, is sometimes considered permissible. (188)

override: **1.** To preempt, manually or automatically, a prescribed procedure. *Note:* For example, one might manually override a prescribed course of action programmed to occur in the event of a fault. **2.** In telephony, the entering of or seizure of, a busy circuit, *i.e.*, an occupied circuit, by a party other than those using the circuit. (188) *Note:* For example, an attendant might override a circuit after a busy verification, or a user with a higher precedence level might override a circuit.

overshoot: **1.** In the transition of any parameter from one value to another, the transitory value of the parameter that exceeds the final value. *Note:* Overshoot occurs when the transition is from a lower value to a higher value. When the transition is from a higher value to a lower value, and the parameter takes a transitory value that is lower than the final value, the phenomenon is called "*undershoot*." **2.** The increased amplitude of a portion of a nonsinusoidal waveform, *i.e.*, signal, at the output of a nonlinear circuit, *e.g.*, a realizable amplifier, caused by the characteristics of the circuit. (188). *Note 1:* Overshoot causes distortion of the signal. *Note 2:* Overshoot may result from circuit design parameters that are intended to decrease the response time of the circuit. *Note 3:* The amount of overshoot in a given circuit is designed to minimize response time while maintaining distortion of the signal within acceptable limits. The absence or presence of overshoot, and if present, its magnitude, is a function of a circuit design parameter called

“damping.” See illustration under waveform. 3.
The result of an unusual atmospheric, *e.g.*, ionospheric, condition that causes microwave signals to be received where they are not intended.

over-the-air rekeying (OTAR): Changing traffic encryption key or transmission security key in remote crypto-equipment by sending new key directly to the remote crypto-equipment over the communication path it secures. [NIS]

over-the-horizon radar: A radar system that makes use of the atmospheric reflection and refraction phenomena to extend its range of detection beyond line of sight. Over-the-horizon radars may be either forward scatter or backscatter systems. [JP1]

overtone: Of a sinusoidal wave, an integral multiple of the frequency, *i.e.*, the fundamental, of the wave, other than the fundamental itself. *Note 1:* The first overtone is twice the frequency of the fundamental, and thus corresponds to the second harmonic; the second overtone is three times the frequency of the fundamental, and thus corresponds to the third harmonic, *etc.* *Note 2:* Use of the term *overtone* is generally confined to acoustic waves, especially in applications related to music. *Contrast with fundamental, harmonic.*

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